

# Recreational Use Attainability Analysis for South Lilly Creek (0409B) in the Cypress Creek River Basin

Prepared for:  
Texas State Soil and Water Conservation Board  
Project 16-60

Prepared by:  
Leah Taylor  
Sarah Robinson

Texas Institute for Applied Environmental Research  
Tarleton State University  
Stephenville, Texas

TR1612

Fall 2017

## **Acknowledgements**

Funding for this project was provided through a Texas State Soil and Water Conservation Board (TSSWCB) State General Revenue Nonpoint Source Grant, project number 16-60, Recreational Use Attainability Analysis for One Water Body in the Sulphur River Basin and One Water Body in the Cypress Creek River Basin. This project was sponsored by the TSSWCB through the Texas Institute for Applied Environmental Research (TIAER) at Tarleton State University in Stephenville, Texas.

Mention of trade names or commercial products does not constitute their endorsement.

For more information about this document or any other document TIAER produces, send email to [info@tiaer.tarleton.edu](mailto:info@tiaer.tarleton.edu)

## **Authors**

Leah Taylor, senior project director, TIAER, [ltaylor@tiaer.tarleton.edu](mailto:ltaylor@tiaer.tarleton.edu)

Sarah Robinson, former assistant research scientist, TIAER

## Table of Contents

<b>Acknowledgements .....</b>	<b>ii</b>
<b>Authors .....</b>	<b>ii</b>
<b>Table of Contents.....</b>	<b>iii</b>
<b>List of Figures .....</b>	<b>iv</b>
<b>List of Tables .....</b>	<b>vi</b>
<b>Chapter 1 .....</b>	<b>1</b>
<b>Introduction .....</b>	<b>1</b>
<b>Problem Statement .....</b>	<b>1</b>
<b>Objectives .....</b>	<b>3</b>
<b>Stakeholder and Agency Involvement.....</b>	<b>3</b>
<b>Chapter 2 .....</b>	<b>5</b>
<b>Study Methodology .....</b>	<b>5</b>
Watershed Reconnaissance and Site Selection Strategy.....	5
<b>Survey Methods .....</b>	<b>5</b>
Field Survey Data Collection Activities .....	5
Average Depth at Thalweg and Substantial Pool Depths .....	6
Observational /Anecdotal Data .....	6
Photographs.....	7
<b>Chapter 3 .....</b>	<b>8</b>
<b>Study Area .....</b>	<b>8</b>
<b>Description of South Lilly Creek .....</b>	<b>8</b>
<b>Climatic Conditions .....</b>	<b>8</b>
<b>Land Use and Land Cover.....</b>	<b>9</b>
<b>Regulated Sources.....</b>	<b>13</b>
Wastewater Discharge Facilities .....	13
Regulated Stormwater .....	13
<b>Concentrated Animal Feeding Operations.....</b>	<b>13</b>
<b>Potential Unregulated Sources.....</b>	<b>13</b>
Non-Permitted Agricultural Activities and Domesticated Animals .....	13
Wildlife .....	14
Failing On-Site Sewage Facilities .....	14

Historical Information on Recreational Use .....	15
<b>Chapter 4 .....</b>	<b>17</b>
<b>South Lilly Creek (0409B) .....</b>	<b>17</b>
<b>Survey Site Descriptions.....</b>	<b>17</b>
<b>Field Survey Results and Discussions.....</b>	<b>21</b>
General Description of RUAA Survey Sites and Conditions for South Lilly Creek 0409B.....	21
Physical Description of SL01 .....	29
Physical Description of SL02 .....	30
Physical Description of SL03 .....	32
Physical Description of SL04 .....	34
Physical Description of SL05 .....	36
Physical Description of SL06 .....	38
Physical Description of SL07 .....	40
Physical Description of SL08 .....	42
Physical Description of SL09 .....	44
<b>Observations and Interviews .....</b>	<b>45</b>
Activities Observed .....	45
Activities Interviewed .....	46
<b>Summary .....</b>	<b>46</b>
<b>References.....</b>	<b>50</b>

### List of Figures

Figure 1.1	Watershed of South Lilly Creek (0409B). No permitted wastewater discharges or concentrated animal feeding operations are located in the South Lilly Creek watershed.....	2
Figure 3.1	Monthly average precipitation for Pittsburg, Texas. ....	8
Figure 3.2	Monthly average maximum and minimum air temperatures for Pittsburg, Texas compared to RUAA guidance for field surveys.....	9
Figure 3.3	Land use and land cover of the South Lilly Creek watershed.....	12
Figure 4.1	Watershed of South Lilly Creek (0409B). ....	18
Figure 4.2	Photograph of South Lilly Creek Site SL01 taken on June 21, 2016. The upstream view of the 300-m transect. ....	29
Figure 4.3	Photograph of South Lilly Creek Site SL01 taken on August 24, 2016. The upstream view of the 0-m transect. TIAER personnel in photo.....	30

Figure 4.4	Photograph of South Lilly Creek Site SL02 taken on June 21, 2016. Photograph shows the downstream view of the 300-m transect. ....	31
Figure 4.5	Photograph of South Lilly Creek Site SL02 taken on June 21, 2016. Photograph shows a logjam between the 150-m and 300-m transect.....	32
Figure 4.6	Photograph of South Lilly Creek Site SL03 taken on August 24, 2016, the downstream view of the 0-m transect.....	33
Figure 4.7	Photograph of South Lilly Creek Site SL03 taken on June 21, 2016, water moccasin ( <i>Agkistrodon piscivorous</i> ).....	34
Figure 4.8	Photograph of South Lilly Creek Site SL04 taken on June 21, 2016, the left bank view of the 150-m transect.....	35
Figure 4.9	Photograph of South Lilly Creek Site SL04 taken on August 24, 2016, the downstream view of the 150-m transect.....	35
Figure 4.10	Photograph of South Lilly Creek Site SL05 taken on August 24, 2016, the downstream view of the 120-m transect.....	37
Figure 4.11	Photograph of South Lilly Creek Site SL05 taken on June 21, 2016, the upstream view of the 150-m transect. TIAER personnel in photo.....	38
Figure 4.12	Photograph of South Lilly Creek Site SL06 taken on June 21, 2016, the downstream view of the 150-m transect.....	39
Figure 4.13	Photograph of South Lilly Creek Site SL06 taken on August 23, 2016, the upstream view of the 300-m transect. ....	39
Figure 4.14	Photograph of South Lilly Creek Site SL07 taken on June 21, 2016, the downstream view of the 300-m transect.....	40
Figure 4.15	Photograph of South Lilly Creek Site SL07 taken on August 24, 2016, the upstream view of the 150-m transect .....	41
Figure 4.16	Photograph of South Lilly Creek Site SL08 taken on June 21, 2016, the downstream view of the 0-m transect.....	42
Figure 4.17	Photograph of South Lilly Creek Site SL08 taken on August 23, 2016, the upstream view of the 0-m transect. ....	43
Figure 4.18	Photograph of South Lilly Creek Site SL09 taken on June 20, 2016, the upstream view of the 150-m transect. ....	44
Figure 4.19	Photograph of South Lilly Creek Site SL09 taken on August 23, 2016, the upstream view of the 0-m transect. TIAER personnel in photo.....	45
Figure 4.20	Summary of observed and interviewed human activities on South Lilly Creek. ....	48

## List of Tables

Table 3.1	Land use/land cover classes within the South Lilly Creek watershed.....	10
Table 3.2	Estimated livestock numbers within the South Lilly Creek watershed based on statistics for Upshur, Wood, and Camp Counties and adjusted for the percent of the county represented by the watershed. (Source: USDA, 2012).....	14
Table 4.1	Description and location of RUAA field survey sites for South Lilly Creek, Water Body 0409B. ....	19
Table 4.2	Rainfall records with maximum and minimum temperature for Pittsburg, Texas 30 days prior to the first RUAA survey initiated on June 20 – 21, 2016. ....	22
Table 4.3	Rainfall records with maximum and minimum temperature for Pittsburg, Texas 30 days prior to the second RUAA survey initiated on August 23 – 24, 2016. ....	23
Table 4.4	Stream channel and corridor appearance for each site sampled along South Lilly Creek (0409B). ....	24
Table 4.5	Thalweg depth, stream flow type, and site accessibility during the two surveys of South Lilly Creek (0409B). ....	25
Table 4.6	Description of surveyed stream sites along South Lilly Creek during first survey performed in June 20 – 21, 2016. ....	26
Table 4.7	Description of surveyed stream sites along South Lilly Creek during second survey performed in August 23 – 24, 2016. ....	26
Table 4.8	Stream aesthetics along South Lilly Creek during first survey performed in June 20 – 21, 2016. ....	27
Table 4.9	Stream aesthetics along South Lilly Creek during second survey performed in August 23 – 24, 2016. ....	28
Table 4.10	Summary of recreational activities noted in interviews for South Lilly Creek. ....	46

## Chapter 1

### Introduction

#### Problem Statement

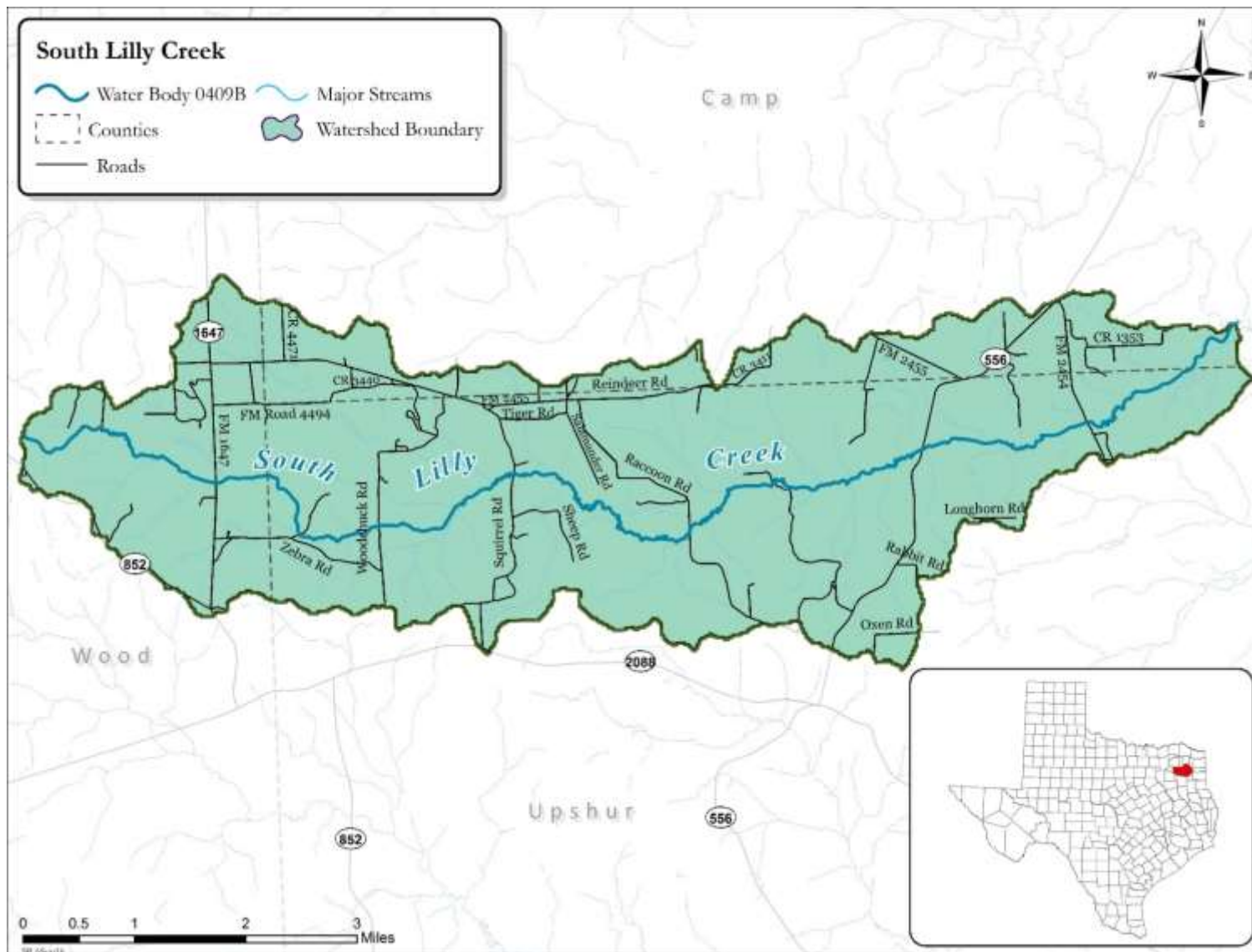
South Lilly Creek (0409B) is an unclassified water body identified for assessment purposes by the Texas Commission on Environmental Quality (TCEQ). South Lilly Creek is approximately fifteen river miles long and is comprised of only one assessment unit (AU). The 2014 Texas Integrated Report of Surface Water Quality (TCEQ, 2014a) defines South Lilly Creek (0409B) as being located from the confluence of Lilly Creek to approximately 2 miles west of Farm-to-Market (FM) 1647 (Figure 1.1). South Lilly Creek (0409B) was first listed on the Texas 303(d) list as impaired for bacteria in 2006 and has continued to be listed as impaired for bacteria on the 2008, 2010, 2012, and 2014 Texas 303(d) lists. There are no additional impairments for South Lilly Creek. [The Texas Integrated Report of Surface Water Quality<sup>1</sup>](https://www.tceq.texas.gov/waterquality/assessment/305_303.html) includes the Texas 303(d) list of impaired water bodies and is available online dating back to 1992.

South Lilly Creek (0409B) has a presumed use of primary contact recreation based on the *Texas Surface Water Quality Standards* (TSWQS) (TCEQ, 2014a). Prior to June 2010 only two categories of recreation use, contact and noncontact, existed in Texas. In June 2010, the TCEQ adopted revisions to the TSWQS that expanded the designation of contact recreation into three categories (primary contact recreation, secondary contact recreation 1, and secondary contact recreation 2) based on varying degrees of interaction with the water, while maintaining a fourth category of noncontact recreation. These revisions were codified in the Texas Administrative Code (TAC), Title 30 Chapter 307 and became effective as a state rule on July 22, 2010 (TCEQ, 2010). As a result of these revisions to the TSWQS, all water bodies listed as impaired based on bacteria for contact recreation are scheduled to undergo a standards review to determine if primary contact recreation is appropriate or if a revision to the use category for recreation should be considered.

Use attainability analyses (UAAs) are studies to evaluate the designated or presumed uses of a water body. In order to identify and assign attainable uses and criteria to individual water bodies, UAAs evaluate physical, chemical, biological, and economic factors affecting use attainment of a water body (40 Code of Federal Regulations §131.10(g)). A recreational use attainability analysis (RUAA) is a specific type of UAA focused on determining the appropriate recreational use category of a water body, the findings of which are presented within this report for South Lilly Creek (0409B).

---

<sup>1</sup> [https://www.tceq.texas.gov/waterquality/assessment/305\\_303.html](https://www.tceq.texas.gov/waterquality/assessment/305_303.html)



**Figure 1.1** Watershed of South Lilly Creek (0409B). No permitted wastewater discharges or concentrated animal feeding operations are located in the South Lilly Creek watershed.



## Objectives

The objective of this report is to present the findings of a Comprehensive RUAA for South Lilly Creek following the TCEQ March 2014 *Procedures for a Comprehensive RUAA and a Basic RUAA Survey* (TCEQ, 2014b). An RUAA consists of three parts: field surveys to document water body characteristics and signs of recreation, interviews with stakeholders regarding past and current use of the water body, and a historical review regarding recreational use of the water body. All components of this RUAA were performed by Texas Institute for Applied Environmental Research (TIAER), which is located on the campus of Tarleton State University in Stephenville, Texas. Field surveys and interviews for the RUAA were conducted under a Texas State Soil and Water Conservation Board (TSSWCB) approved Quality Assurance Project Plan (QAPP; TIAER, 2016).

## Stakeholder and Agency Involvement

The TSSWCB and its collaborating entities maintain an inclusive public participation process. From the inception of this project, the project team sought to ensure that stakeholders were informed and involved. TIAER provided coordination for public participation for this project.

Input from the TCEQ regional staff, United States Geological Survey regional staff, Texas Parks and Wildlife Department (TPWD) regional staff, TSSWCB, Northeast Texas Municipal Water District, the Wood, Upshur-Gregg, and Sulphur-Cypress Soil and Water Conservation Districts, and other local agencies was solicited as well as input from watershed stakeholders on the need for the RUAA (see Contact Information Form available on the project website noted below).

Meetings with state agencies, river authority representatives, local officials, and stakeholders were held to give an overview of water quality issues within the South Lilly Creek watershed and to obtain comments on proposed survey sites prior to field data collection. Meetings targeted local and state agencies as well as stakeholders in an effort to inform them of the assessment of water quality within South Lilly Creek and the need for an RUAA. TIAER representatives met with Upshur-Gregg Soil and Water Conservation District on February 3, 2016, Wood Soil and Water Conservation District on February 9, 2016, and Sulphur-Cypress Soil and Water Conservation District on February 11, 2016.

A public meeting focusing specifically on the RUAA was held at the Hanson – Sewell Center located in Pittsburg, Texas on April 11, 2016. At this meeting input was sought on the proposed sampling sites for the South Lilly Creek RUAA. Attendees provided information regarding activities that typically occur within the watershed and offered assistance in accessing the stream via privately owned property.

On July 21, 2016, a second public meeting was held at the Hanson – Sewell Center to inform stakeholders of the findings from the first RUAA field survey that was conducted on June 20 – 21, 2016. The importance of interviews in providing feedback on past recreational use was emphasized by TIAER. Interview forms were made available at this meeting as well as through the project website. Several attendees agreed to complete interviews.

A final public meeting occurred on August 21, 2017 at the Hanson – Sewell Center to inform stakeholders of the findings of both field surveys. The next steps of the RUAA were discussed at

this meeting and feedback from stakeholders was solicited. At the meeting, stakeholders were informed that the draft RUAA report was open for public review and comment. The draft report is available via the project website. Additionally, TIAER provided hard copies if desired by individuals.

Watershed stakeholders were invited to attend public meetings through mailed invitations, public announcements (TIAER website), and individual phone calls. Information on past meetings for this RUAA, presentations, and other information, can be found on the project's website: [South Lilly Creek Project Webpage](http://tiaer.tarleton.edu/ruaa/south-lilly-creek.html)<sup>2</sup>

---

<sup>2</sup> <http://tiaer.tarleton.edu/ruaa/south-lilly-creek.html>

## **Chapter 2**

### **Study Methodology**

The process of developing a list of sites to be surveyed for the RUAA began with a reconnaissance of potential locations along each water body. A combination of Geographic Information System (GIS) data, review of historical information, and meetings and phone conversations with local entities and stakeholders were used to determine sites included in the RUAA field surveys.

#### **Watershed Reconnaissance and Site Selection Strategy**

Reconnaissance of each watershed was conducted to collect background information before selecting appropriate sites for each RUAA. To the degree possible, site reconnaissance was coordinated with watershed stakeholders in an effort to increase local landowner interest in water quality issues. The March 2014 RUAA procedures (TCEQ, 2014) recommends selecting three sites per every five miles of stream. Based on this recommendation, the recommended number of sites for South Lilly Creek was nine.

The following information was compiled using Geographic Information System (GIS) based tools prior to, during, and immediately following the watershed reconnaissance:

- Location of areas along the water body that were accessible to the public and had the highest potential for recreational use, such as road crossings and parks;
- Location of permitted wastewater outfalls and other potential point sources;
- Hydrologic characteristics, such as stream type, streamflow, and hydrologic alterations; and
- Location of city boundaries or other designated population areas.

The site selection process took into account locations that were accessible to the public, had the highest potential for recreational use, and that were established TCEQ monitoring stations where historical data may have been collected. The site selection process also considered parks and bridge crossings along the river, as well as access through private lands adjacent to the river.

#### **Survey Methods**

##### **Field Survey Data Collection Activities**

As specified in the procedures for a Comprehensive RUAA (TCEQ, 2014), two separate field surveys occurred at each selected survey site during the warm season (air temperature greater than or equal to 70 degrees Fahrenheit or 21 degrees Celsius) when human recreational activities were most likely to occur (May - September). Ideally, field surveys were to be conducted when stream flow conditions were normal. Rainfall data 30 days prior to each survey were also documented to provide antecedent conditions.

Data collection activities at each RUAA site for both field surveys included the following:

- Measurement of average depth at thalweg (deepest depth),
- Measurement of depths, lengths, and widths of substantial pools,
- Documentation of observational/anecdotal data required on the RUAA field data sheets,
- Photographs of any signs of recreation and
- Photographs of site conditions including upstream, downstream, left bank, and right bank photos at the 0-m, 150-m, and 300-m transects.

### **Average Depth at Thalweg and Substantial Pool Depths**

Determination of thalweg and substantial pool depths is applicable to contact recreation use determination for intermittent and perennial freshwaters according to TCEQ (2014). The thalweg is defined as the deepest depth of a transect perpendicular to the stream channel. A substantial pool was defined as a pool greater than 1-m (3.28-ft) deep and 10-m (32.8-ft) long for the purposes of the RUAA survey (TCEQ, 2014).

As instructed in the RUAA procedures manual (TCEQ, 2014), a 300-m reach at each site was evaluated to determine average thalweg depth. Eleven transects at 30-m intervals were established along the reach. Transects were labeled upstream to downstream with the 300-m transect at the most upstream point of the survey and the 0-m transect being the most downstream. Thalweg was measured at each of the eleven transects. Where significant pools were encountered along the 300-m reach, depths, widths and lengths were measured and recorded. Depths, lengths and widths are presented in meters as per the RUAA procedures (TCEQ, 2014).

### **Observational /Anecdotal Data**

Anecdotal information was recorded on field data sheets during all surveys using the field data sheets from the TSSWCB-approved QAPP (TIAER, 2014).

Types of observational and anecdotal records included, but were not limited to, the following:

- Channel flow status as indicated by flow severity
- Stream type (e.g., ephemeral, intermittent, etc.)
- Riparian zone characteristics (forest, pasture, eroded banks, etc.)
- Stream accessibility
- Substrate type
- Anecdotal information related to observed human contact activities

## **Photographs**

TIAER staff created photographic records of each site during the site surveys. Photographs were intended to clearly depict the characteristics of the channel and any evidence of observed uses or indications of human use, hydrologic modifications, etc. Photographs were taken specifically at the 0-m, 150-m, and 300-m transects (as described in the Field Data Sheets). Any items of interest, e.g., obstructions, were also photographed. Photographs were used to document evidence of recreational use (e.g., fishing tackle) and actual recreation. Photographs were also used to document a lack of use (e.g., dry creek beds) or impediments to recreational use. In addition, as part of the overall project, photographs were taken to indicate potential bacteria sources to the water body. All photographs were labeled in a manner that indicated the date, site location, orientation to the stream, and photo's subject. Selected photos representative of each RUAA field site are included with the survey results for each water body in this report.

## Chapter 3

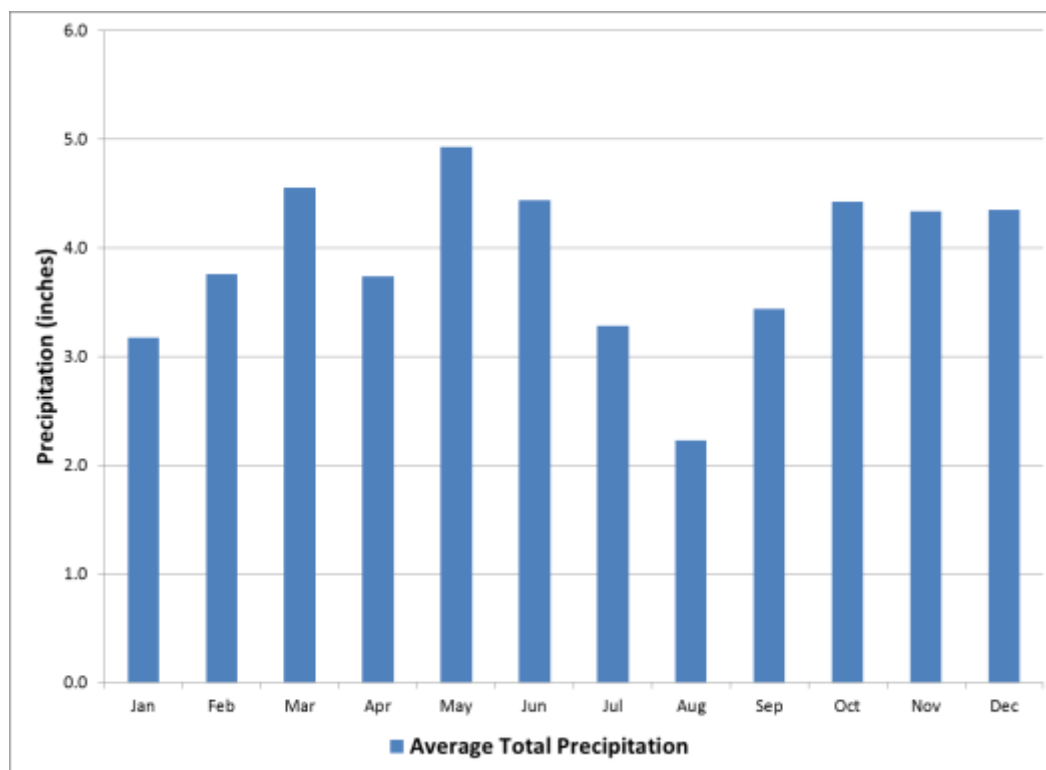
### Study Area

#### Description of South Lilly Creek

South Lilly Creek is primarily located in Upshur County with portions of the stream extending into Wood and Camp Counties in the northeastern portion of Texas. Water body 0409B is within the Cypress Creek Basin. The small watershed is approximately 14,500 acres (roughly 23 square miles) with a population of 474 (USCB, 2010). The watershed does not encompass any cities or parks within its boundaries. The nearest city to the watershed is Pittsburg, Texas (population 4,513) (USCB, 2010). Rural neighborhoods are present but scattered throughout the South Lilly Creek watershed.

#### Climatic Conditions

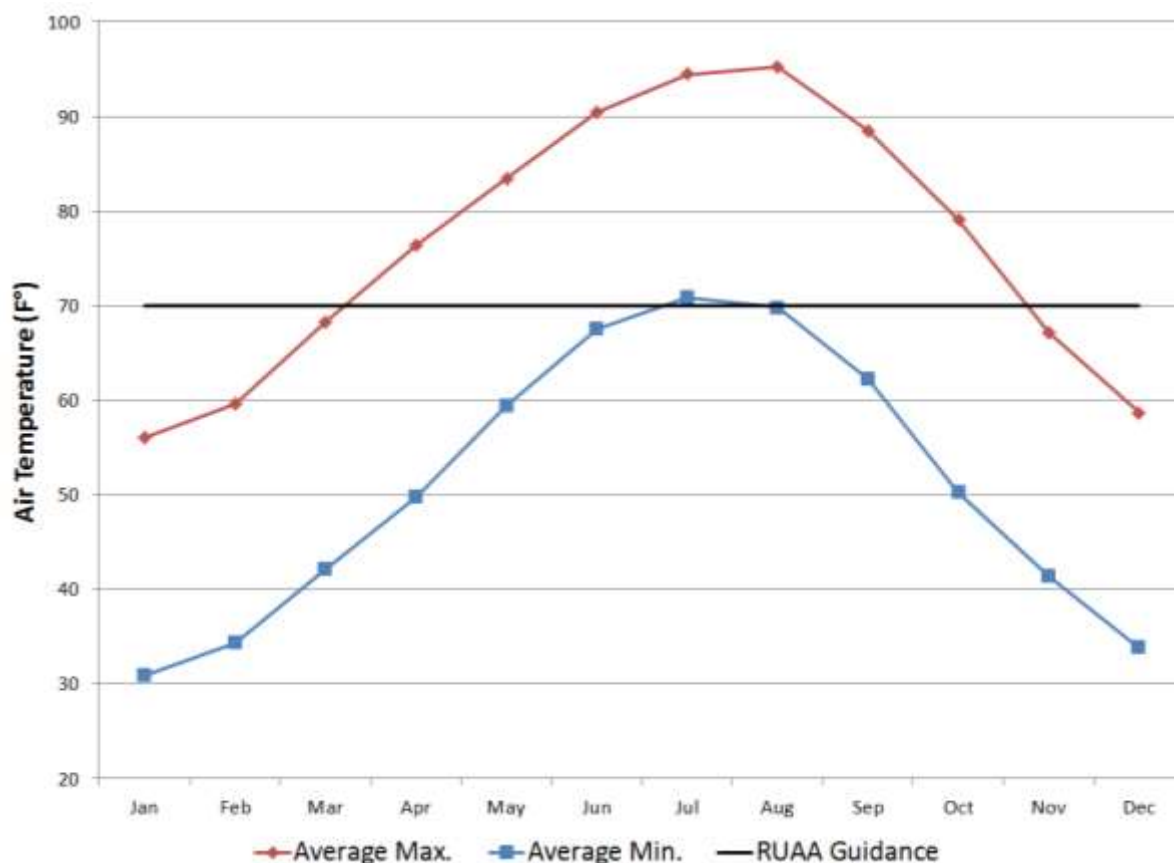
Annual precipitation for the South Lilly Creek watershed was based on data obtained from the National Oceanic and Atmospheric Administration's website (NOAA, 2015) for Pittsburg, Texas. It is important to note that Pittsburg is not within the South Lilly Creek watershed boundaries, but is the nearest town. Because there are no cities within the watershed, the historical data for Pittsburg was used. Normal precipitation (1974-2015) for Pittsburg, Texas averages 46.7 inches per year with peak rainfall typically occurring in the months of March and May (Figure 3.1).



**Figure 3.1** Monthly average precipitation for Pittsburg, Texas.

Source: NOAA (2015) based on data for 1974-2015.

Average maximum temperatures for Pittsburg, Texas rise above 70° F beginning in March and continue through October (Figure 3.2). March through October are the months noted as generally suitable for assessing recreational use, but only if temperatures reach above 70° F (TCEQ, 2014b).



**Figure 3.2** Monthly average maximum and minimum air temperatures for Pittsburg, Texas compared to RUAA guidance for field surveys.

Source: NOAA (2015) based on data for 1974-2015 and TCEQ (2014).

### Land Use and Land Cover

The South Lilly Creek watershed lies within the Tertiary Uplands ecoregion as defined in the publication *Ecoregions of Texas* (Griffith et al., 2007). The Tertiary Uplands ecoregion's deposits are primarily Eocene sediments, with minor amounts of Paleocene and Cretaceous sediments. The soil surface textures are typically sandy and loamy.

The dominant land cover within South Lilly Creek is Pasture/Hay at 37.12% and is present throughout the watershed (Table 3.1 and Figure 3.3). Deciduous Forest is the secondary land cover encompassing 30.5% of the South Lilly Creek watershed. As previously stated, South Lilly Creek largely flows through rural areas. The combined land cover for developed land use (low, medium, and high intensity and open space) totals to 5.94%. South Lilly Creek has no parks located along its mainstem.

**Table 3.1 Land use/land cover classes within the South Lilly Creek watershed.**

Source: 2011 National Land Cover Database (USGS, 2011).

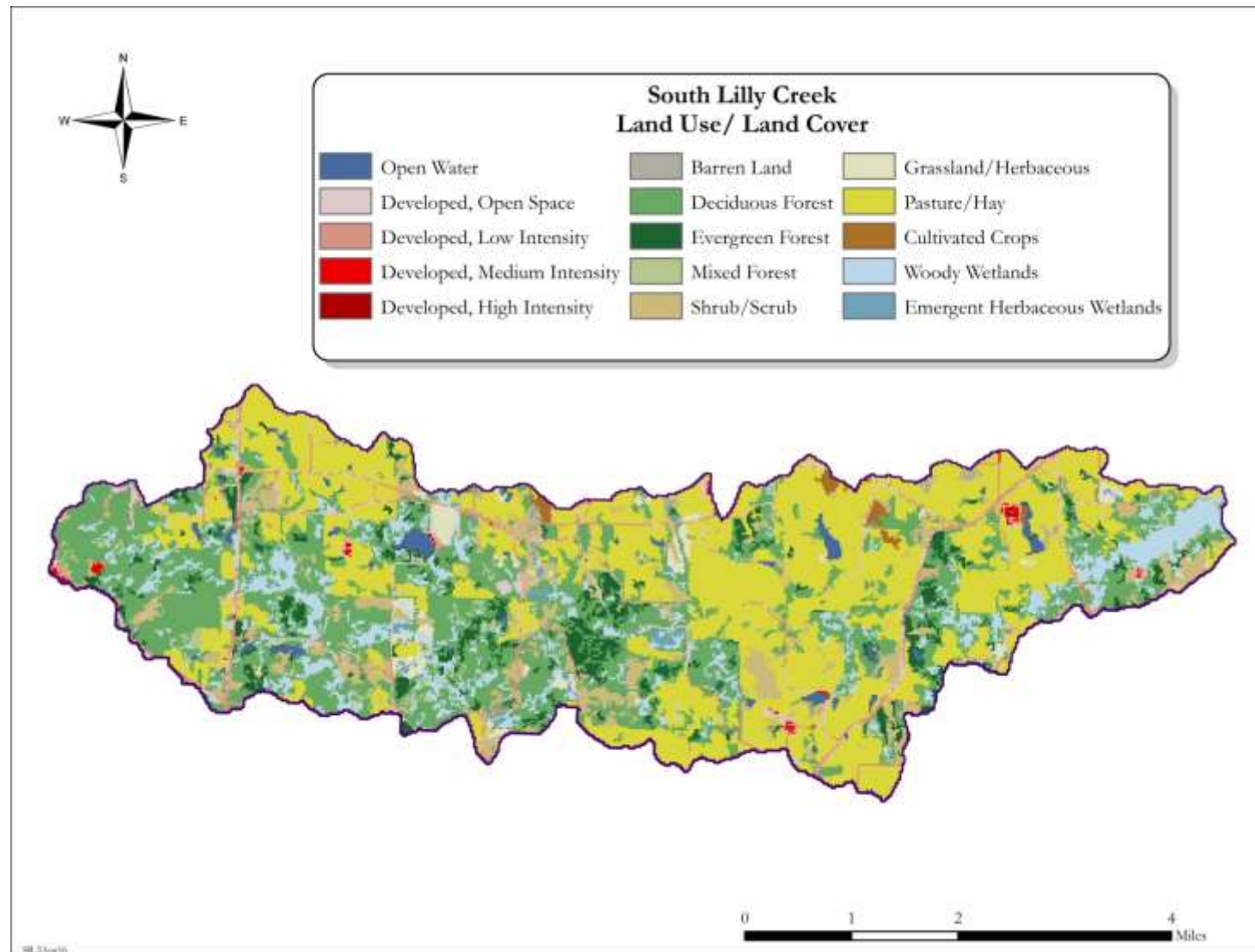
Class	Area (acres)	Percent (%)
Pasture/Hay	5380	37.12
Deciduous Forest	4421	30.50
Woody Wetlands	1253	8.65
Shrub/Scrub	1087	7.50
Evergreen Forest	739	5.10
Developed, Low Intensity	447	3.08
Developed, Open Space	375	2.59
Grassland/Herbaceous	244	1.68
Open Water	203	1.40
Mixed Forest	110	0.76
Emergent Herbaceous Wetlands	83	0.57
Cultivated Crops	71	0.49
Barren Land (Rock/Sand/Clay)	39	0.27
Developed, Medium Intensity	35	0.24
Developed, High Intensity	5	0.03
TOTAL	14,492	100%

The land use/land cover for the watershed area was obtained from the National Land Cover Database (NLCD) maintained by the U.S. Geological Survey (USGS, 2011). The land use/land cover categories within the watershed are described as follows from the NLCD legend:

- **Pasture/Hay** – Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
- **Deciduous Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
- **Woody Wetlands** – Areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- **Shrub/Scrub** – Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.



- **Evergreen Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.
- **Developed, Low Intensity** – Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.
- **Developed, Open Space** – Areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot, single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- **Grassland/Herbaceous** – Areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
- **Open Water** – Areas of open water, generally with less than 25% cover of vegetation or soil.
- **Mixed Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.
- **Emergent Herbaceous Wetlands** – Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- **Cultivated Crops** – Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.
- **Barren Land (Rock/Sand/Clay)** – areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
- **Developed, Medium Intensity** – Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.
- **Developed High Intensity** – Highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.



**Figure 3.3** Land use and land cover of the South Lilly Creek watershed.

Source: 2011 National Land Cover Database (USGS, 2011).

## **Regulated Sources**

Potential sources of fecal pollution, as measured by indicator bacteria *Escherichia coli* (*E. coli*), can be divided into two primary categories: regulated and unregulated. Pollution sources that are regulated have permits issued by TCEQ under the Texas Pollutant Discharge Elimination System (TPDES) and/or by the USEPA under the National Pollutant Discharge Elimination System (NPDES) and are generally point sources. Examples of regulated sources include domestic and industrial wastewater treatment facilities (WWTFs); stormwater from industries, construction, and municipal separate storm sewer systems (MS4s) of cities; and concentrated animal feeding operations (CAFOs). These various regulated sources are required to have either an individual permit that is specific for each facility or a general permit for operation.

## **Wastewater Discharge Facilities**

There are no wastewater treatment facilities within the South Lilly Creek (0409B) watershed.

## **Regulated Stormwater**

The TPDES and the NPDES Municipal Separate Storm Sewer (MS4) Phase I and II rules require municipalities and certain other entities in urban areas to obtain permits for their stormwater systems. Phase I permits are individual permits for large and medium sized communities with populations exceeding 100,000, whereas Phase II permits are for smaller communities that are located within an “Urbanized Area”. An “Urbanized Area” is defined by the U.S. Census Bureau as an area with populations greater than 50,000 and with an overall population density of at least 1,000 people per square mile. Because there are no cities within the South Lilly Creek watershed, there are no entities required to obtain a stormwater permit.

## **Concentrated Animal Feeding Operations**

There are currently no permitted CAFOs located within the watershed of South Lilly Creek (0409B).

## **Potential Unregulated Sources**

Unregulated sources are typically nonpoint source in nature, meaning the pollution originates from multiple diffuse locations and is usually carried to surface waters by rainfall runoff, and the sources are not regulated by permit under the TPDES and NPDES. Potential unregulated sources include wildlife (mammals and birds), large exotics, unmanaged feral animals (e.g., feral hogs), on-site sewage facilities (OSSFs), pets, and livestock.

## **Non-Permitted Agricultural Activities and Domesticated Animals**

Activities such as livestock grazing close to water bodies and agricultural use of manure as fertilizer can contribute *E. coli* to nearby water bodies. Livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website (USDA, 2012). While these are county level statistics and thus only a very rough estimate of livestock in the watershed (Table 3.2), these statistics indicate that beef cattle, goats, and horses are the most common livestock found within the watershed.

**Table 3.2**      **Estimated livestock numbers within the South Lilly Creek watershed based on statistics for Upshur, Wood, and Camp Counties and adjusted for the percent of the county represented by the watershed. (Source: USDA, 2012).**

The South Lilly Creek watershed comprises about 67% of Upshur County, 17% of Wood County, and 16% of Camp County.

County	Cattle & Calves (all beef)	All Goats	All Sheep	Horses & ponies	Hogs & Pigs
Upshur	39,271	2,525	269	3,344	144
Wood	46,020	2,107	1,494	2,658	86
Camp	20,424	232	374	1,003	549
Proportional Average for South Lilly Creek Watershed	37,403	2,087	494	2,853	199

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (USEPA, 2009). A rough estimate of the dog and cat population can be computed assuming there are 0.584 dogs and 0.638 cats per household (AVMA, 2012). According to the 2010 census there are 237 households within the South Lilly Creek watershed which indicates that there are potentially 138 dogs and 151 cats residing within the watershed.

### Wildlife

*E. coli* bacteria are common inhabitants of the intestines of all warm blooded animals, including wildlife such as mammals and birds. Wildlife are naturally attracted to riparian corridors of streams and rivers. With direct access to the stream channel, the deposition of wildlife waste can be a concentrated source of bacteria loading to a water body. Fecal bacteria from wildlife are also deposited onto land surfaces, where it may be washed into nearby streams by rainfall runoff.

### Failing On-Site Sewage Facilities

Septic systems or on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. As there are no cities or wastewater dischargers indicating centralized sewer systems in the South Lilly Creek watershed, all households were assumed to have OSSFs. To estimate the number of potential OSSFs in the watershed, population data from the U.S. Census Bureau were used. The 2010 U.S. Census Bureau (USCB) data indicated that all 237 households in the South Lilly Creek watershed are outside municipal areas and likely on septic systems.

## Historical Information on Recreational Use

A review of historical information was performed regarding recreational water uses for South Lilly Creek. The review considered the time period of November 28, 1975 to the present in accordance with 40 CFR Part 131 (EPA standards regulation). Government offices, libraries, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review and searches.

### Government Sources:

City of Pittsburg

[City of Pittsburg Homepage<sup>3</sup>](#)

Search retrieved no results.

North East Texas Municipal Water District

[North East Texas Municipal Water District<sup>4</sup>](#)

Robert Speight

Team Leader

(903) 639-7538

Contacted on September 12, 2016 by Leah Taylor

Mr. Speight stated that he did not know of any primary contact recreational uses such as swimming or children wading that had occurred in South Lilly Creek.

Upshur County

[Upshur County Homepage<sup>5</sup>](#)

Search retrieved no results.

Camp County

[Camp County Homepage<sup>6</sup>](#)

Search retrieved no results.

### Library Sources:

The City of Pittsburg Public Library

[City of Pittsburg Public Library Homepage<sup>7</sup>](#)

Phone: (903) 856-3302

Searched online catalog. Search retrieved no results.

### Newspaper Sources:

The Pittsburg Gazette

[The Pittsburg Gazette Homepage<sup>8</sup>](#)

Phone: (903) 856-6629

Explored various links and online texts. Search retrieved no results.

### Internet Searches:

The Handbook of Texas Online

[The Handbook of Texas Online - Search for South Lilly Creek<sup>9</sup>](#)

Searched the handbook by creek name. Search retrieved no results.

Texas Escapes Online Magazine

[Texas Escapes Online Magazine - Search for South Lilly Creek<sup>10</sup>](#)

Nothing significant was found.

---

<sup>3</sup> <http://www.pittsburgtexas.com/>

<sup>4</sup> <http://www.netmwd.com/>

<sup>5</sup> <http://www.countyofupshur.com/>

<sup>6</sup> <http://www.co.camp.tx.us/>

<sup>7</sup> <http://www.pittsburglibrary.org/>

<sup>8</sup> <http://thepittsburggazette.com/>

<sup>9</sup> <http://www.tshaonline.org/>

<sup>10</sup> <http://www.texasescapes.com/>

## **Chapter 4**

### **South Lilly Creek (0409B)**

#### **Survey Site Descriptions**

South Lilly Creek (0409B) is 15.2 river miles long indicating a goal of nine sites (3 sites per 5 miles of river) for the RUAA survey. With the help of cooperating stakeholders, TIAER was able to establish a total of nine survey sites along South Lilly Creek (Figure 4.1 and Table 4.1). Seven of the nine sites were located at public road crossings while two sites were accessible via private property.

At six of the seven publicly accessible sites, there was actually very limited public access due to private property fences upstream and downstream of the crossings. Access to the stream between road crossings was moderately difficult due to steep banks and dense vegetation, in addition to the areas being private property. Two of the publicly accessible sites were co-located with TCEQ sampling stations. The average distance between survey sites was 1.36 river miles and ranged from 0.83 river miles to 2.57 river miles. The largest gap between sites was 2.57 river miles between sites SL05 and SL06. RUAA surveys were performed June 20 – 21, 2016 and August 23 – 24, 2016 at all locations. A brief description of each site follows.

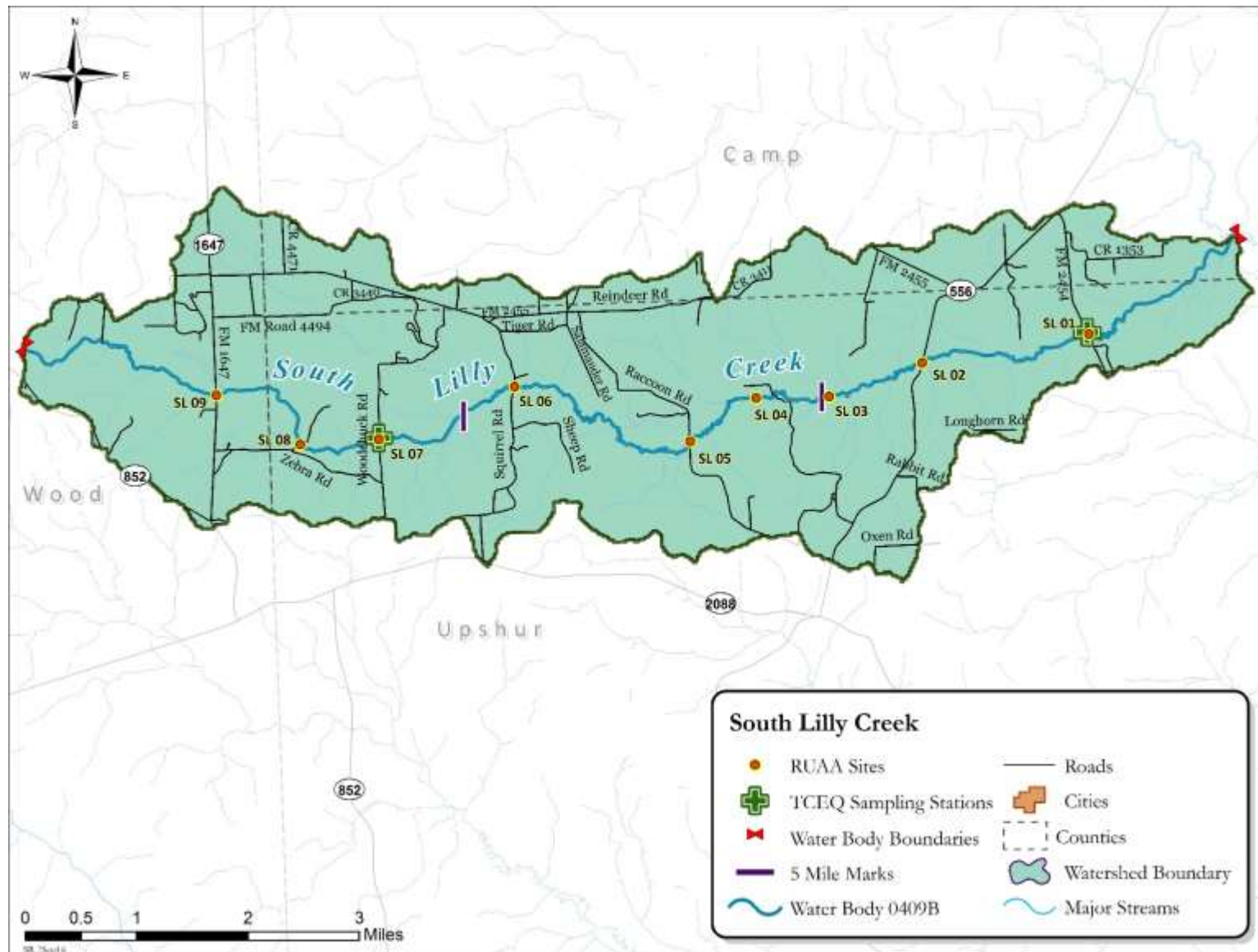


Figure 4.1 Watershed of South Lilly Creek (0409B).



**Table 4.1 Description and location of RUAA field survey sites for South Lilly Creek, Water Body 0409B.**

<b>Site ID</b>	<b>TCEQ ID</b>	<b>Site Description</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Distance from Confluence (mi)<sup>1</sup></b>	<b>Distance from Previous Site (mi)<sup>1</sup></b>	<b>Access</b>
SL01	17954	South Lilly Creek at FM 2454 about 1.8 KM south of the intersection with FM 556 and Southwest of Pittsburg	32.896232	-95.025195	2.04	0.00	Public*
SL02		South Lilly Creek at FM 556	32.889277	-95.066208	3.80	1.76	Public*
SL03		On private property about 1.12 miles west of FM 556	32.889346	-95.065568	4.92	1.12	Private
SL04		On private property about 0.99 miles east of Raccoon Road	32.889511	-95.076858	5.76	0.84	Private
SL05		South Lilly Creek at Raccoon Road	32.884187	-95.087282	6.74	0.98	Public*
SL06		South Lilly Creek at Squirrel Road	32.892161	-95.114051	9.31	2.57	Public*
SL07	17953	South Lilly Creek at Woodchuck Road 3.11 KM downstream of FM 1647 and 9.5 miles south of Lake Cypress Springs	32.885961	-95.135272	10.91	1.59	Public*
SL08		South Lilly Creek at Waterbuck Road	32.885662	-95.147420	11.74	0.83	Public*
SL09		South Lilly Creek at FM 1647	32.892469	-95.160094	12.90	1.16	Public

<sup>1</sup>Distances were digitally estimated using the measuring tool in ArcGIS 10.1 with the 2010 National Agriculture Imagery Program (NAIP) 1-m digital orthophoto quarter quads (DOQQs) and the National Hydrography Dataset (NHD) stream layer as reference guides.

\* Indicates public access limited to the bridge area due to fenced private property upstream and downstream of the crossing.

Site SL01 is the most downstream site located on South Lilly Creek 2.04 miles from confluence with Lilly Creek at FM 2454. This site is publicly accessible at the bridge only with about 30 m of right of way between the highway and private property fencing. Access to complete the surveys required land owner permission to enter the stream by crossing a barbed wire fence.

Site SL02 is located on South Lilly Creek 3.8 miles from the confluence with Lilly Creek at FM 556. This site is publicly accessible at the road crossing only, with a private property fence restricting further access. Landowner permission to cross the fence away from the road crossing was required to complete the surveys.

Site SL03 is located on South Lilly Creek 4.92 miles from the confluence with Lilly Creek on private property. Access to this site was possible by turning southwest off of FM 2455 onto private property. The property owner needed to unlock the gate prior to access. Travel by vehicle approximately 1.4 miles and then travel on foot another 0.23 miles was required to access the site. Landowner cooperation and permission were granted to complete surveys at this location.

Site SL04 is located on South Lilly Creek 5.76 miles from the confluence with Lilly Creek on private property. Access to this site was possible by turning southwest off of FM 2455 onto private property. The property owner needed to unlock the gate prior to access. Travel by vehicle approximately 1.75 miles to a cross fence, climbing over the cross fence, then travelling by foot an additional 0.10 miles was required to access the site. Landowner cooperation and permission were granted to complete surveys at this location.

Site SL05 is located on South Lilly Creek 6.74 miles from the confluence with Lilly Creek at Raccoon Road. This site is only publicly accessible at the bridge, with a private property fence restricting further access. Landowner permission to cross the fence away from the road crossing was required to complete the surveys.

Site SL06 is located on South Lilly Creek 9.31 miles from the confluence with Lilly Creek at Squirrel Road. This site is only publicly accessible at the road crossing, with a private property fence restricting further access. Landowner permission to cross the fence away from the road crossing was required to complete the surveys.

Site SL07 is located on South Lilly Creek 10.91 miles from the confluence with Lilly Creek at Woodchuck Road. This site is publicly accessible at the road crossing only, with a private property fence restricting further access. Landowner permission to cross the fence away from the road crossing was required to complete the surveys.

Site SL08 is located on South Lilly Creek 11.74 miles from the confluence with Lilly Creek at Waterbuck Road. This site is publicly accessible at the road crossing only, with a private property fence restricting further access. Landowner permission was sought and granted allowing TIAER personnel to cross the fence to complete the surveys.

Site SL09 is located on South Lilly Creek 12.9 miles from the confluence with Lilly Creek at FM 1647. This site is publicly accessible from the roadway with no private property fence bisecting the creek.

## Field Survey Results and Discussions

### General Description of RUAA Survey Sites and Conditions for South Lilly Creek 0409B

The South Lilly Creek RUAA surveys were conducted on June 20 – 21 and August 23 – 24, 2016 at all nine sites. The surveys were performed on weekdays, weekends, or holidays at opportune times to observe recreational activities. Air temperatures prior to and during both the first and second surveys were above 21°C (70°F), indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 4.2 and 4.3). In the 30 days prior to the first survey, 4.16 inches of precipitation fell, while 5.28 inches fell 30 days prior to the second survey. These rainfall events did not cause a hindrance to accessing the stream. The Palmer Drought Severity Index (PDSI) indicated extremely wet (index value: 4.16) conditions for East Texas during June, 2016 and very wet (index value: 3.22) conditions during August, 2016 (TWDB, 2016).

A summary of the RUAA field survey results is presented in the following tables:

- Table 4.4 describes the stream channel and corridor characteristics at each site.
- Table 4.5 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 4.6 and 4.7 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.
- Tables 4.8 and 4.9 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. All sites but SL03 and SL04 were at public road crossings. Sites SL03 and SL04 were located on private property. Overall thalweg depth averaged 0.53 m for the first survey and > 0.45 m for the second survey. Access to the stream was difficult or moderately difficult at six of the nine sites due to steep, densely vegetated banks. The dominant substrate was mud, clay, and sand with occasional gravel, and the majority of the stream corridor was lined with shrubs and pasture except in a few locations where forest adjoined the stream. The maximum stream width encountered was 14 m at the bridge crossing at Site SL02. Typical stream widths were wider at the most downstream Site SL01 (3.0 to 4.0 m), and gradually narrowed to 1.5 m while traveling upstream. Flow conditions appeared high during the first survey and normal during the second except at Site SL09 where flows appeared normal during both surveys. The water was brown in color at all sites during both surveys. The water surface at most sites was clear during the first survey with foam or scum apparent at only two sites. Five sites had obvious foam and/or scum during the second survey. This foam or scum was primarily observed on the upstream side of log jams or debris piles. Evidence of wildlife was observed at all sites, most commonly in the form of raccoon tracks. Sites SL01, SL03, SL05, and SL08 revealed the presence of venomous and/or non-venomous snakes. Two water moccasins were encountered at both SL03 and SL05 and one at SL08. Non-venomous snakes were encountered at SL01, SL03, and SL05. Trash was rarely observed at most survey sites and when observed was typically plastics, aluminum cans, and bottles. A hunting blind was observed at SL05 but was set away from the creek about 100 m. No other evidence of recreation was observed at the other eight survey sites.

**Table 4.2      Rainfall records with maximum and minimum temperature for Pittsburg, Texas 30 days prior to the first RUAA survey initiated on June 20 – 21, 2016.**

Survey dates are highlighted in gray. Weather Data from Weather Underground; station KTXPTTS2 in Pittsburg, TX. (Weather Underground, 2016)

<b>Date</b>	<b>Daily Precipitation (in)</b>	<b>High Temperature (°F)</b>	<b>Low Temperature (°F)</b>
20-May-16	0	79	62
21-May-16	0	83	55
22-May-16	0	83	64
23-May-16	0.10	84	65
24-May-16	0	86	67
25-May-16	0	90	74
26-May-16	0.13	79	67
27-May-16	0.27	71	65
28-May-16	0	82	64
29-May-16	0	89	68
30-May-16	0.12	84	67
31-May-16	2.03	88	67
1-Jun-16	0.30	78	67
2-Jun-16	0.22	75	70
3-Jun-16	0.20	80	69
4-Jun-16	0.36	83	67
5-Jun-16	0.01	87	63
6-Jun-16	0	88	64
7-Jun-16	0.03	90	63
8-Jun-16	0	92	65
9-Jun-16	0	92	67
10-Jun-16	0	91	69
11-Jun-16	0	91	70
12-Jun-16	0.26	92	71
13-Jun-16	0.13	87	72
14-Jun-16	0	92	74
15-Jun-16	0	91	76
16-Jun-16	0	95	76
17-Jun-16	0	94	72
18-Jun-16	0	95	73
19-Jun-16	0	90	71
20-Jun-16	0	90	71
21-Jun-16	0	94	73

**Table 4.3 Rainfall records with maximum and minimum temperature for Pittsburg, Texas 30 days prior to the second RUAA survey initiated on August 23 – 24, 2016.**

Survey dates are highlighted in gray. Weather Data from Weather Underground; station KTXPTTS2 in Pittsburg, TX. (Weather Underground, 2016)

<b>Date</b>	<b>Daily Precipitation (in)</b>	<b>High Temperature (°F)</b>	<b>Low Temperature (°F)</b>
23-Jul-16	0	100	75
24-Jul-16	0	99	73
25-Jul-16	0	96	74
26-Jul-16	0	96	73
27-Jul-16	0	97	73
28-Jul-16	0	89	71
29-Jul-16	0	95	71
30-Jul-16	0	98	70
31-Jul-16	0	97	72
1-Aug-16	0	99	76
2-Aug-16	0	99	76
3-Aug-16	0.06	101	78
4-Aug-16	0	101	78
5-Aug-16	0	102	78
6-Aug-16	0	101	78
7-Aug-16	0.05	100	75
9-Aug-16	0.37	97	76
10-Aug-16	0	97	74
11-Aug-16	0	99	74
12-Aug-16	0	100	77
13-Aug-16	0	102	74
14-Aug-16	0.13	89	75
15-Aug-16	0	85	75
16-Aug-16	2.22	75	71
17-Aug-16	0.18	78	72
18-Aug-16	0.84	79	72
19-Aug-16	0.90	81	72
20-Aug-16	0.48	86	73
21-Aug-16	0.05	81	73
22-Aug-16	0	84	73
23-Aug-16	0	97	73
24-Aug-16	0	93	73

**Table 4.4 Stream channel and corridor appearance for each site sampled along South Lilly Creek (0409B).**

<b>Site Number</b>	<b>Stream Channel Appearance</b>	<b>Dominant Substrate</b>	<b>Corridor Appearance</b>	<b>Riparian Size</b>	<b>Park</b>	<b>Landscape Surroundings</b>
SL01	Natural	Mud/Clay	Shrub/Pasture	Small	No	Native/Improved Pasture
SL02	Natural	Mud/Clay	Pasture	Small	No	Native/Improved Pasture
SL03	Natural	Mud/Clay/Sand	Forest/Pasture	Small	No	Native/Improved Pasture
SL04	Natural	Mud/Clay/Sand	Pasture	Small	No	Native/Improved Pasture
SL05	Natural	Gravel	Forest/Pasture/Shrub	Small	No	Native/Improved Pasture
SL06	Natural	Mud/Clay/Sand	Shrub/Pasture	Small	No	Native/Improved Pasture
SL07	Natural	Mud/Clay/Sand	Shrub/Pasture	Small	No	Native/Improved Pasture
SL08	Natural	Gravel/Mud/Clay/Sand	Shrub/Pasture	Small	No	Native/Improved Pasture
SL09	Natural	Sand/Silt	Forest	Small	No	Native

**Table 4.5 Thalweg depth, stream flow type, and site accessibility during the two surveys of South Lilly Creek (0409B).**

Stream flow type represents observed stream characteristics on the date of the survey. Under general access, \* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property. For Bank Access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, D = Difficult.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type Survey 1	Stream Flow Type Survey 2	General Access	Bank Access
SL01	300	11	0	0.5	0.4	Perennial	Intermittent	Public*	D
SL02	300	11	0	1.3	> 0.93	Perennial	Perennial	Public*	MD
SL03	300	11	0	0.58	0.43	Perennial	Perennial	Private	D
SL04	300	11	0	0.84	0.86	Perennial	Intermittent with Perennial Pools	Private	ME
SL05	300/180 <sup>a</sup>	11/7 <sup>a</sup>	0	0.25	0.32 <sup>a</sup>	Intermittent	Intermittent	Public*	D
SL06	300	11	0	0.53	0.49	Perennial	Perennial	Public*	MD
SL07	300	11	0	0.37	0.26	Perennial	Intermittent	Public*	D
SL08	300	11	0	0.23	0.16	Perennial	Intermittent	Public*	ME
SL09	300	11	0	0.21	0.24	Intermittent	Intermittent	Public	E

<sup>a</sup> During the second survey, only 180 m of reach length and 7 transects were surveyed. The average thalweg depth is, thus, based on 7 rather than 11 transects for Trip 2. A more detailed explanation is provided below in site description.

**Table 4.6** Description of surveyed stream sites along South Lilly Creek during first survey performed in June 20 – 21, 2016.

<b>Site Number</b>	<b>Maximum Width (m)</b>	<b>Minimum Width (m)</b>	<b>Typical Average Width (m)</b>	<b>Observed Flow</b>
SL01	7.0	2.5	4.0	High
SL02	14	1.6	2.6	High
SL03	4.6	1.0	2.5	High
SL04	7.8	2.0	3.0	High
SL05	9.0	1.0	2.5	High
SL06	5.0	1.3	2.0	High
SL07	5.0	0.50	2.1	High
SL08	8.0	0.80	2.1	High
SL09	2.0	0.10	1.5	Normal

**Table 4.7** Description of surveyed stream sites along South Lilly Creek during second survey performed in August 23 – 24, 2016.

<b>Site Number</b>	<b>Maximum Width (m)</b>	<b>Minimum Width (m)</b>	<b>Typical Average Width (m)</b>	<b>Observed Flow</b>
SL01	7.0	1.5	3.0	Normal
SL02	14	1.6	2.6	Normal
SL03	4.5	0.90	2.5	Normal
SL04	7.6	2.0	3.0	Normal
SL05	9.0	1.0	2.5	Normal
SL06	5.0	1.3	2.0	Normal
SL07	5.0	0.50	2.1	Normal
SL08	9.0	0.61	1.5	Normal
SL09	2.0	0.10	1.5	Normal



**Table 4.8 Stream aesthetics along South Lilly Creek during first survey performed in June 20 – 21, 2016.**

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
SL01	A	R	N	Brown	Fine Sediments	Clear	N	N	MP	Tracks/Fecal Droppings	N	N	N
SL02	A	A	N	Brown	Fine Sediments	Clear	N	SP	N	Tracks/Fecal Droppings	N	N	N
SL03	A	A	N	Brown	Fine Sediments	Clear	SP	SP	SP	Tracks/Fecal Droppings	N	N	N
SL04	A	A	N	Brown	Fine Sediments	Clear	N	SP	LP	Tracks/Fecal Droppings	N	N	N
SL05	A	A	R	Brown	Solids	Clear/ Foam	SP	N	N	Tracks/Fecal Droppings	N	R	N
SL06	Ab	A	N	Brown	Fine Sediments	Scum	N	N	SP	Tracks/Fecal Droppings	N	N	N
SL07	C	A	N	Brown	Fine Sediments	Clear	N	N	SP	Tracks/Fecal Droppings	N	C	N
SL08	A	A	N	Brown	Fine Sediments/Solids	Clear	N	N	SP	Tracks/Fecal Droppings	N	R	N
SL09	R	A	N	Brown	Fine Sediments	Clear	N	N	N	Tracks/Fecal Droppings	N	R	N

**Table 4.9 Stream aesthetics along South Lilly Creek during second survey performed in August 23 – 24, 2016.**

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence. NA indicates not applicable because conditions were dry.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
SL01	A	A	N	Brown	Fine Sediment	Clear	SP	SP	SP	Fecal Droppings	N	N	N
SL02	A	A	N	Brown	Fine Sediment	Clear	N	SP	N	Tracks/Fecal Droppings	N	N	N
SL03	R	R	N	Brown	Fine Sediment	Foam/Scum/Clear	SP	N	SP	Tracks/Fecal Droppings	N	R	R
SL04	A	A	N	Brown	Fine Sediment	Foam/Scum/Clear	N	SP	SP	Fecal Droppings	N	N	N
SL05	A	A	R	Brown	Solids	Foam	SP	N	N	N	N	R	N
SL06	Ab	A	N	Brown	Fine Sediment	Scum	N	N	N	Tracks	N	N	N
SL07	C	A	N	Brown	Fine Sediment	Clear	N	N	SP	N	N	C	N
SL08	A	A	N	Brown	Fine Sediment	Clear	SP	N	N	N	N	N	N
SL09	R	A	N	Brown	Fine Sediment	Clear/Foam	N	N	N	N	N	N	N

### Physical Description of SL01

South Lilly Creek site SL01 was visited on June 21 and August 24, 2016. This site was located where FM 2454 intersects the creek. The site was only publically accessible at an approximately 35 m wide right-of-way associated with the road. There was no safe place for a vehicle to park on the shoulder of the road. Access was difficult because the right-of-way was overgrown and a private property fence extended across the creek approximately 20 m upstream of the bridge. TIAER personnel accessed the creek upstream of the bridge by wading under the water gap created by the fence. The survey reach for this site extended onto private property thus permission from the landowner was acquired prior to the surveys.

The creek at this site passes through improved pastures with native vegetation. The riparian area was small with trees and native pasture often leading directly up to the edge of the stream bank. Banks were steep and approximately 1 m high in places. Livestock trails leading into the creek existed occasionally along this stretch. The general appearance of the creek at this location is shown in Figures 4.2 and 4.3.



**Figure 4.2** Photograph of South Lilly Creek Site SL01 taken on June 21, 2016. The upstream view of the 300-m transect.

Site SL01 was wadeable with average thalweg ranging from 0.50 m to 0.40 m between surveys. Figure 4.2 illustrates the typical observed width of the creek at this site, approximately 3.5 m. Widths ranged from 7.0 m to 1.5 m during the two surveys (Tables 4.6 and 4.7).

The stream flow type at the time of the first survey appeared to be perennial but was designated as intermittent during the second survey (Table 4.5). Fish and aquatic vegetation were not observed

at this site, and algae cover was rarely observed. The shallowest thalweg depth measured during the second survey at the 240-m transect was 0.10 m. These factors combined indicate the strong probability that South Lilly Creek at this site likely experiences times of zero flow. The deepest depth measured during the second survey was 0.80 m at the 270-m transect. In the event that water levels dropped to no-flow status, the depth at the 270-m transect would likely not be deep enough to constitute a pool ( $> 0.5\text{-m}$  deep  $\times$  10-m long, SWQM Procedures, Vol.2, 2007). Additionally, the Palmer Drought Index indicated extremely wet and very wet conditions for this region of Texas for the first and second surveys respectively. These factors and measured conditions suggest the stream type most appropriate for this site is intermittent.



**Figure 4.3** Photograph of South Lilly Creek Site SL01 taken on August 24, 2016. The upstream view of the 0-m transect. TIAER personnel in photo.

There were a few water dependent birds and a snake observed during the second survey along with cattle in adjacent pastures, observed during both surveys (Tables 4.8 and 4.9). Raccoon and cattle tracks were observed during the first survey with no tracks observed during the second survey. Cattle feces were observed during both surveys. Aquatic vegetation was absent during both surveys, and algae cover was rarely detected during only the first survey. Neither trash nor evidence of human presence was observed throughout the reach during either survey.

### **Physical Description of SL02**

South Lilly Creek at Site SL02 was visited on June 21 and August 24, 2016. This site was located at the Highway 556 bridge crossing. Access to this site was moderately difficult because there was very minimal space to park a vehicle on the side of the road, the banks were steep leading down to the water, and further access upstream and downstream was obstructed by private property fence.

With landowner permission, TIAER personnel crossed over the water gap upstream from the bridge to complete the surveys.

Similar to SL01, the stream at SL02 also passed through open pasture land with a small riparian area (Table 4.4). However the banks were vegetated with larger trees and a larger shaded understory (Figure 4.4). While some depths allowed for wading, non-wadeable depths were encountered during both surveys. Because the banks were relatively clear of dense vegetation, TIAER personnel were able to take measurements, photos and observations from the top of the banks at non-wadeable transects. Average thalweg depths ranged from 1.3 m to 0.93 m between surveys, and the stream flow type was characterized as perennial during both surveys (Table 4.5). The banks at this site were mostly vertical. Although thalweg depths generally decreased from the first survey to the second, the channel width remained the same throughout the reach during both surveys. Channel widths ranged from 14 m to 1.6 m across both surveys with a typical observed width of 2.6 m (Tables 4.6 and 4.7).

One log obstruction was observed during both surveys between the 150-m and 300-m transect as shown in Figure 4.5.



**Figure 4.4** Photograph of South Lilly Creek Site SL02 taken on June 21, 2016. Photograph shows the downstream view of the 300-m transect.





**Figure 4.5**      **Photograph of South Lilly Creek Site SL02 taken on June 21, 2016. Photograph shows a logjam between the 150-m and 300-m transect.**

Water dependent birds were observed at this site during both surveys (Tables 4.8 and 4.9). Bird droppings, raccoon feces, and cow manure were also observed in addition to cow and raccoon tracks. Evidence of wildlife included sighting of a crawfish burrow, turtles, frog, and small fish. Aquatic vegetation and algae were absent during both surveys. No odor was detected, water color was brown, and the surface clear during each survey. Neither evidence of human recreation nor trash was observed at this site during both surveys.

### **Physical Description of SL03**

South Lilly Creek at Site SL03 was visited on June 21 and August 24, 2016. This site was accessed via a private property traveling a total of approximately 1.65 miles southwest off of FM 2455. Access was granted by the landowner to enter the property leading to South Lilly Creek. TIAER personnel traveled by truck through a locked gate and continued through pastureland approximately 1.4 miles before walking the remaining 0.23 miles to begin the survey. The riparian area was forested on the left bank and predominantly pasture on the right bank (Table 4.4). However, the right bank vegetation was knee-high during the first survey and about shoulder-height of TIAER personnel during the second survey making travel to the creek difficult.

Site SL03 was wadeable during both surveys with average thalwegs of 0.58 m and 0.43 m respectively (Table 4.5). The stream flow type was characterized as perennial during both surveys for this reach. Similar to SL02, stream widths at SL03 varied little between surveys with a maximum width of 4.6 m during the first survey and 4.5 m during the second. Minimum widths

were 1.0 m during the first survey and 0.9 m during the second and the typical width was 2.5 m during both surveys (Tables 4.6 and 4.7).

The stream banks were densely vegetated (as seen in Figure 4.6) at SL03. Logs, downed trees, smaller limbs, and twig debris (floating and submerged) were common in the channel. Aquatic vegetation and algae cover were absent during the first survey and observed rarely during the second survey. No odor was encountered and the color of the water was brown during both surveys. The surface of the water was clear during the first survey, while foam and scum were encountered at some locations along the 300 m reach during the second survey.



**Figure 4.6** Photograph of South Lilly Creek Site SL03 taken on August 24, 2016, the downstream view of the 0-m transect.

Two water moccasins were encountered by TIAER personnel while walking in the channel during the first survey (Figure 4.7). A ribbon snake, a green tree frog, and other frog species were encountered during the second survey. Other evidence of wildlife observed were crawfish burrows, water dependent birds, canine tracks, raccoon tracks, and unknown fecal material. A half-eaten bird carcass was also seen on the bank. No large garbage was encountered during either survey, but some small in channel and bank garbage in the form of plastic bottles was observed during the second survey (Tables 4.8 and 4.9). No evidence of human recreation was observed at this site.



**Figure 4.7** Photograph of South Lilly Creek Site SL03 taken on June 21, 2016, water moccasin (*Agkistrodon piscivorus*)

#### **Physical Description of SL04**

South Lilly Creek at Site SL04 was visited on June 21 and August 24, 2016. This site was located on private property approximately 1.75 miles from FM 2455. Access to the site was granted by the landowner to the property leading to South Lilly Creek. TIAER personnel traveled by truck through a locked gate and continued through pastureland about 1.65 miles for the first survey before crossing over a fence and walking the remaining 0.10 miles to conduct the survey. Pastures through which South Lilly Creek runs were not navigable by vehicle after 4.6 inches of rain that fell within at least 10 days of the second survey. Therefore, during the second survey, TIAER personnel traveled by truck approximately 1.4 miles then walked the remaining approximate 0.35 miles to the site, also crossing the same fence as was done in the first survey. The riparian area associated with SL04 is small and is immediately bounded on both banks by improved pasture (Table 4.4). The general appearance of the creek at this location is shown in Figures 4.8 and 4.9.





**Figure 4.8**      **Photograph of South Lilly Creek Site SL04 taken on June 21, 2016, the left bank view of the 150-m transect.**



**Figure 4.9**      **Photograph of South Lilly Creek Site SL04 taken on August 24, 2016, the downstream view of the 150-m transect.**

Site SL04 was wadeable for the entire 300 m reach with an average thalweg of 0.84 m during the first survey and 0.86 m during the second survey (Table 4.5). Widths of the stream were similar during both surveys and ranged from 7.8 m to 2.0 m with a typical width of 3.0 m (Tables 4.6 and 4.7).

The stream flow type at the time of the first survey appeared to be perennial. Fish, aquatic vegetation, and algae cover were not observed at this site. The shallowest depth measured during the second survey at the 300-m transect was 0.20 m. These three factors combined indicate the strong probability that South Lilly Creek at this site likely experiences times of zero flow. The deepest depth measured during the second survey was 1.8 m at the 210-m transect. In the event that water levels dropped to no-flow status, the depth noted at the 210-m transect could possibly be deep enough to constitute a pool (> 0.5-m deep x 10-m long, SWQM Procedures, Vol.2, 2007). Additionally, the Palmer Drought Index indicated extremely wet and very wet conditions for this region of Texas for the first and second surveys respectively. These factors and measured conditions suggest the stream type most appropriate for this site is intermittent with perennial pools.

Crawfish burrows were observed throughout the 300-m stretch along with turtles and bullfrogs. Ducks and a great blue heron were also seen at this site. Cattle were observed in the pastures alongside the stream. Cattle manure and tracks were seen along the banks as well (Tables 4.8 and 4.9). Aquatic vegetation and algae were absent during both surveys. The brown colored water had a clear surface during the first survey but had surface foam and scum during the second survey. No trash or evidence of human recreation was observed at the site.

### **Physical Description of SL05**

South Lilly Creek at Site SL05 was visited on June 21 and August 24, 2016. This site was located where the creek passes through a culvert pipe under Raccoon Road. Raccoon Road is a narrow, dirt road with insufficient room to park a vehicle completely off the road. Site SL05 was publicly accessible at the crossing but was fenced upstream and downstream of the crossing. The stream corridor consisted primarily of forest and shrubs with some pasture located along the right bank (Table 4.4). Access to the stream was difficult due to the vertical, 4-foot tall banks and dense vegetation (Table 4.5). The general appearance of the site during each survey is shown in Figures 4.10 and 4.11.

Site SL05 was wadeable for the entire 300-m reach with average thalweg depths of 0.25 m during the first survey and 0.32 m during the second survey (Table 4.5). The stream flow types due to the shallow thalweg depths throughout the reach was characterized as intermittent during both surveys. Unlike the other RUAA survey sites on South Lilly Creek, the dominate substrate of the stream at this site was gravel. Widths remained about the same during both surveys and ranged from a maximum of 9.0 m to a minimum of 1.0 m, with a typical average width of approximately 2.5 m (Tables 4.6 and 4.7).

During the second survey, which was started at the 300-m transect, a logjam was encountered at the 120-m transect (Figure 4.11). A water snake, encountered at this location, struck the boot of a TIAER field crew member. Additionally, a water moccasin was observed in the vicinity of the logjam and water snake. The banks were steep and densely vegetated, occasionally with poison

ivy. Other submerged and overhanging obstructions were encountered within the channel. Navigating through the obstruction was the only option and would require bending down with shoulders and face near the debris and water where the presence of a venomous snake was confirmed. Due to these factors, further assessment of this site was terminated at the 120-m transect. Only 7 of the 11 transects (120 m through 300 m) were completed during the second survey at Site SL05.



**Figure 4.10** Photograph of South Lilly Creek Site SL05 taken on August 24, 2016, the downstream view of the 120-m transect.

Tracks of raccoon, deer, canine, and hog were seen at this site (Tables 4.8 and 4.9). Frogs and crawfish burrows were also observed in the channel and up on the banks. Aquatic vegetation and algae cover were absent, while an odor was occasionally detected during both surveys. The water color was brown with surface foam observed during each survey. Trash was rarely observed within the channel, and when encountered, consisted of typical plastics, bottles, and a tire. No other trash, large or small, was observed along the banks throughout the survey reach. A hunting blind was seen tucked among trees approximately 100 m from the right bank of the stream. Due to its distance from the stream, no photo was taken of the blind. No other evidence of human recreation was observed at this site.





**Figure 4.11** Photograph of South Lilly Creek Site SL05 taken on June 21, 2016, the upstream view of the 150-m transect. TIAER personnel in photo.

### Physical Description of SL06

South Lilly Creek at Site SL06 was visited on June 21 and August 23, 2016. This site was located where the creek passes through a culvert pipe under Squirrel Road. Similar to Raccoon Road, Squirrel Road is a narrow dirt road with insufficient room to park a vehicle completely off the road. TIAER personnel parked about 0.10 mile up the road in a pasture entrance and walked to the creek. Site SL06 was publicly accessible at the road but was fenced upstream and downstream of the crossing. Lack of close parking and private property fencing perpendicular to the stream made access moderately difficult. With landowner permission, TIAER personnel crossed over the fence and continued to complete the survey upstream of the road. The stream corridor was narrow with a small riparian area consisting primarily of shrub and herbaceous vegetation with interspersed trees. Open pasture existed out beyond the brush on both banks (Table 4.4). Figures 4.12 and 4.13 depict the general appearance of the site during each of the surveys.

Site SL06 was wadeable for the entire 300-m reach length. Average thalweg during the first survey was 0.53 m and 0.49 m during the second survey, and the stream flow type was characterized as perennial during both surveys (Table 4.5). Because pastureland existed up to the brushy banks, TIAER personnel were able to walk easily along the banks to characterize the site. Widths of the stream did not vary from one survey to the next and ranged from 5.0 m to 1.3 m with a typical average width of 2.0 m (Tables 4.8 and 4.9).



**Figure 4.12** Photograph of South Lilly Creek Site SL06 taken on June 21, 2016, the downstream view of the 150-m transect.



**Figure 4.13** Photograph of South Lilly Creek Site SL06 taken on August 23, 2016, the upstream view of the 300-m transect.



Tracks of raccoon and cattle were observed in the channel, as were a snakeskin, small fish, crawfish burrows, and a large unknown burrow in the bank (Tables 4.8 and 4.9). Three domestic dogs were observed in the creek upon commencement of the first survey. Aquatic vegetation was abundant during both surveys in the form of equisetum, cattails, and sedges. Algae was absent and the water color was brown with surface scum during both surveys. An irrigation pipe was observed extending across the creek from inside the banks. Trash was not encountered in the channel or along the stream banks. No evidence of recreational activity was observed at this site.

### Physical Description of SL07

South Lilly Creek at Site SL07 was visited on June 21 and August 24, 2016. This site was located where the creek passes through a culvert pipe under Woodchuck Road. Similar to other roads in the area, Woodchuck Road is narrow with insufficient space to park a vehicle completely off the road. Site SL07 was publicly accessible at the crossing but was fenced upstream and downstream of the crossing. Private property fencing perpendicular to the stream made access difficult. With landowner permission, TIAER personnel crossed over the fence and continued to complete the survey downstream of the road crossing. The stream corridor was narrow with a small riparian area consisting primarily of shrub and herbaceous vegetation with interspersed trees (Table 4.4). Pastureland existed beyond the corridor on the right bank, while the left banks were primarily shrub land beyond the banks. Bank access was difficult due to densely vegetated banks and steep slopes. Logjams were encountered including one large one at the 180-m transect. Figures 4.14 and 4.15 depict the general appearance of the site during each of the surveys.



**Figure 4.14** Photograph of South Lilly Creek Site SL07 taken on June 21, 2016, the downstream view of the 300-m transect.



**Figure 4.15** Photograph of South Lilly Creek Site SL07 taken on August 24, 2016, the upstream view of the 150-m transect.

Site SL07 was wadeable during both surveys with average thalweg depths of 0.37 m during the first survey and 0.26 m during the second (Table 4.5). Widths were the same during both surveys and ranged from 5.0 m to 0.50 m with a typical overall width of 2.1 m (Tables 4.6 and 4.7).

The stream flow type at the time of the first survey appeared to be perennial. The shallowest depth measured was during the second survey and was 0.08 m at the 180-m transect and a depth of 0.10 m was measured at the 270-m transect. The deepest depth measured during the second survey was 0.56 m at the 90-m transect. These factors combined indicate the strong probability that South Lilly Creek at this site likely experiences times of zero flow. In the event that water levels dropped to no-flow status, the deepest depth at the 180-m transect would not be deep enough to constitute a pool ( $> 0.5$ -m deep x 10-m long, SWQM Procedures, Vol.2, 2007). Additionally, the Palmer Drought Index indicated extremely wet and very wet conditions for this region of Texas for the first and second surveys respectively. These factors and measured conditions suggest the stream type most appropriate for this site is intermittent.

Aquatic vegetation was common and algae was absent during both surveys. The water color was brown and clear during both surveys. Cows and calves were observed in the adjacent pastures, the banks, and in the stream during both surveys. Frogs were the only wild vertebrate encountered at this site. Small garbage in the channel was common during both surveys and included aluminum cans, plastic grocery sack, glass bottles, and an empty dog food bag. No evidence of human recreation was observed at this site.



### Physical Description of SL08

South Lilly Creek at Site SL08 was visited on June 21 and August 23, 2016. This site was located where the creek passes through a culvert pipe under Waterbuck Road. Access to this site was public at the road crossing. TIAER personnel entered the creek at the culvert pipe that passed under the road and completed the surveys downstream. A private property fence bisected the creek approximately 15 m downstream of the Waterbuck Road crossing. The riparian area was small at this site. Banks were approximately 0.5 m high on average making bank access moderately easy. In terms of vegetation, the stream corridor had an open understory with trees and shrubs scattered along the banks with a grassy ground cover meeting the edges of the banks. Poison ivy was present along the stream banks. Between 300 m and 250 m of this site, both banks were wooded. From the 250-m transect to the 0-m transect, the right bank opened up to pasture about 20 m from the stream while the left bank remained wooded. Figures 4.16 and 4.17 depict the general appearance of the site during each of the surveys.



**Figure 4.16** Photograph of South Lilly Creek Site SL08 taken on June 21, 2016, the downstream view of the 0-m transect.

Site SL08 was wadeable during both surveys with average thalweg depths of 0.23 m during the first survey and 0.16 m during the second (Table 4.5). Widths did not vary significantly between surveys with a maximum width of 9.0 m, a minimum of 0.61 m, and a typical average width ranging from 2.1 m to 1.5 m during the first and second surveys, respectively (Tables 4.6 and 4.7).



The stream flow type at the time of the first survey appeared to be perennial. The shallowest depth measured was during the second survey and was 0.08 at the 240-m transect. The deepest depth measured during the second survey was 0.3 m at the 210-m transect. No aquatic vegetation or algae were observed during either survey. These factors combined indicate the strong probability that South Lilly Creek at this site likely experiences times of zero flow. In the event that water levels dropped to no-flow status, the deepest depth noted at the 210-m transect during the second survey would not be deep enough to constitute a pool ( $> 0.5$ -m deep x 10-m long, SWQM Procedures, Vol.2, 2007). Additionally, the Palmer Drought Index indicated extremely wet and very wet conditions for this region of Texas for the first and second surveys, respectively. These factors and measured conditions suggest the stream type most appropriate for this site is intermittent.

Aquatic vegetation and algae were absent and the water was brown with a clear surface during both surveys. The primary substrate was sand and silt with gravel in places. A water moccasin was encountered during the second survey upon entering the stream at the road. White tailed deer were also observed running through the riparian corridor during the first survey. Tracks of raccoon and cattle were observed in the channel, as were crawfish burrows, small fish, clamshells, and bird droppings. Garbage was minimal at this site. No large garbage or bank garbage was observed. Small garbage in the channel were found in the form of plastic bottles and a tire during the first survey. No evidence of human recreation was observed at this site.



**Figure 4.17** Photograph of South Lilly Creek Site SL08 taken on August 23, 2016, the upstream view of the 0-m transect.

### Physical Description of SL09

South Lilly Creek at site SL09 was visited June 20, 2016 and August 23, 2016. This site was located at the crossing of South Lilly creek at FM 1647. While FM 1647 is a paved road, it lacks sufficient shoulder space for safe parking. TIAER personnel were required to park up the road at a pasture entrance and walk to the site during the first survey because the ditches along the road were too wet nearer the creek. Drier conditions during the second survey allowed TIAER personnel to park in the bar ditch next to the creek. The stream riparian corridor was small but ran through forest vegetation with dense herbaceous understory (Table 4.4). An overgrown fencerow existed approximately 10 m from the creek on the left bank and a path between the two had recently been cleared upon conducting the first survey. This was the only non-forested area adjacent to this site. Access to this site was easy due to its proximity to a public road and gently sloping banks leading from the bar ditch to the water. There also were no cross fences up or downstream of the road crossing restricting access. Bank vegetation away from the road crossing closed in quickly making access up and out of the channel difficult to impossible. Figures 4.18 and 4.19 depict the general appearance of the site during each of the surveys.



**Figure 4.18** Photograph of South Lilly Creek Site SL09 taken on June 20, 2016, the upstream view of the 150-m transect.

This site was wadeable during both surveys with average thalweg depths of 0.21 m during the first survey and 0.24 m during the second survey, and stream flow type was considered intermittent during both surveys (Table 4.5). Widths were unchanging between the first and second surveys with a maximum width of 2.0 m, minimum width of 0.1 m, and a typical average width of 1.5 m (Table 4.7). Aquatic vegetation was rare and algae cover was absent during both surveys. The



water color was brown during both surveys. The water surface was clear during the first survey, while some foam was encountered during the second survey.

Tracks of bird, raccoon, armadillo, and hog were observed at this site. Small fish, frogs, turtles, and crawfish burrows were also seen (Tables 4.8 and 4.9). Garbage was rare overall at this site with small garbage consisting of aluminum cans and a plastic 5-gallon bucket observed only during the first survey. No evidence of human recreation was observed at this site.



**Figure 4.19** Photograph of South Lilly Creek Site SL09 taken on August 23, 2016, the upstream view of the 0-m transect. TIAER personnel in photo.

## Observations and Interviews

### Activities Observed

During each RUAA survey, field personnel visited sites during times of day and on days when recreational activities were most likely to be observed. Seven of the nine sites were at public road crossings; however, private property boundaries generally limited public access to small areas around and underneath bridge crossings. At Site SL09, there was no private property fence to deter travel downstream, but dense vegetation and shallow depths made accessing this part of the creek difficult beyond the road crossing. No form of recreation was directly observed by TIAER staff during either of the two surveys.

## Activities Interviewed

A total of 11 interviews were collected from landowners along South Lilly Creek as well as other stakeholders with interest in the watershed.

Nine of the 11 interviewees stated they had not personally used, seen others use, or heard of others using the stream for any form of recreation. Two interviews indicated snakes were a reason they did not use the creek for recreation. Lack of flow or shallow waters were other reasons noted for not using South Lilly Creek for recreation. One interviewee noted that the creek was small and too shallow for a canoe or swimming. According to two interviews, watering livestock was the primary use of the creek, and another interviewee indicated the only reason he had gone to the creek was to fix fences. Personal use was indicated only by one interviewee who swam and waded as a child, approximately 35 years ago, and only during a brief period in time. These events occurred roughly between sites SL01 and SL05 (Table 4.10). The only other recreation activity noted in interviews was that hog hunting had been heard to occur along the assessment unit by one interviewee.

Activities listed in Table 4.10 indicate the number of times personal use, observed use, and/or heard of use was documented from interviews for a given location or in general along the assessment unit. Blank cells in Table 4.10 indicate no interviewed feedback for that location.

**Table 4.10 Summary of recreational activities noted in interviews for South Lilly Creek.**

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat, Canoe, Kayak
SL01	3						
SL02	1						
SL03							
SL04							
SL05							
SL06							
SL07							
SL08							
SL09							
General AU	7	1,0,0			0,0,1		
Totals	11	1,0,0			0,0,1		

## Summary

RUAA surveys were conducted at nine sites along South Lilly Creek (0409B) on July 20 – 21, 2016 and August 23 – 24, 2016. Temperatures were above 21°C (70°F) during the 30 days prior to each survey (Tables 4.2 and 4.3). Water existed and flowed in South Lilly Creek during both surveys. Stream flow was considered normal to slightly high during both surveys based on information provided by local residents. The Palmer Drought Severity Index (PDSI) indicated

extremely wet conditions in July, 2016 and very wet conditions during August 2016 (TWDB, 2016).

No recreational activities were observed by TIAER field staff during either survey. Almost 80% of the watershed through which South Lilly Creek passes falls into three types of land use. Improved pasture accounts for the majority at 50%, while deciduous forest and woody wetlands represent 16% and 13% of the watershed, respectively. All sites were represented, at least in part, by pasture land except for Site SL09. Eight snakes total were encountered collectively at 4 of the 9 sites. Five of those snakes were venomous indicating a hazard to recreational activity. Steep banks and logjams were also encountered as obstacles to recreation.

Interviews indicated rare occurrences of recreational activity within the stream with only one person indicating swimming and another hearing of hunting. Public access to the stream is limited primarily to the right-of-ways immediately surrounding bridge crossings or areas immediately up and down stream of culvert crossings, typically ranging from 2 to 30 meters.

Recreational activities observed and reported in interviews are summarized in Figure 4.20. Overall RUAA findings are summarized in the form below.

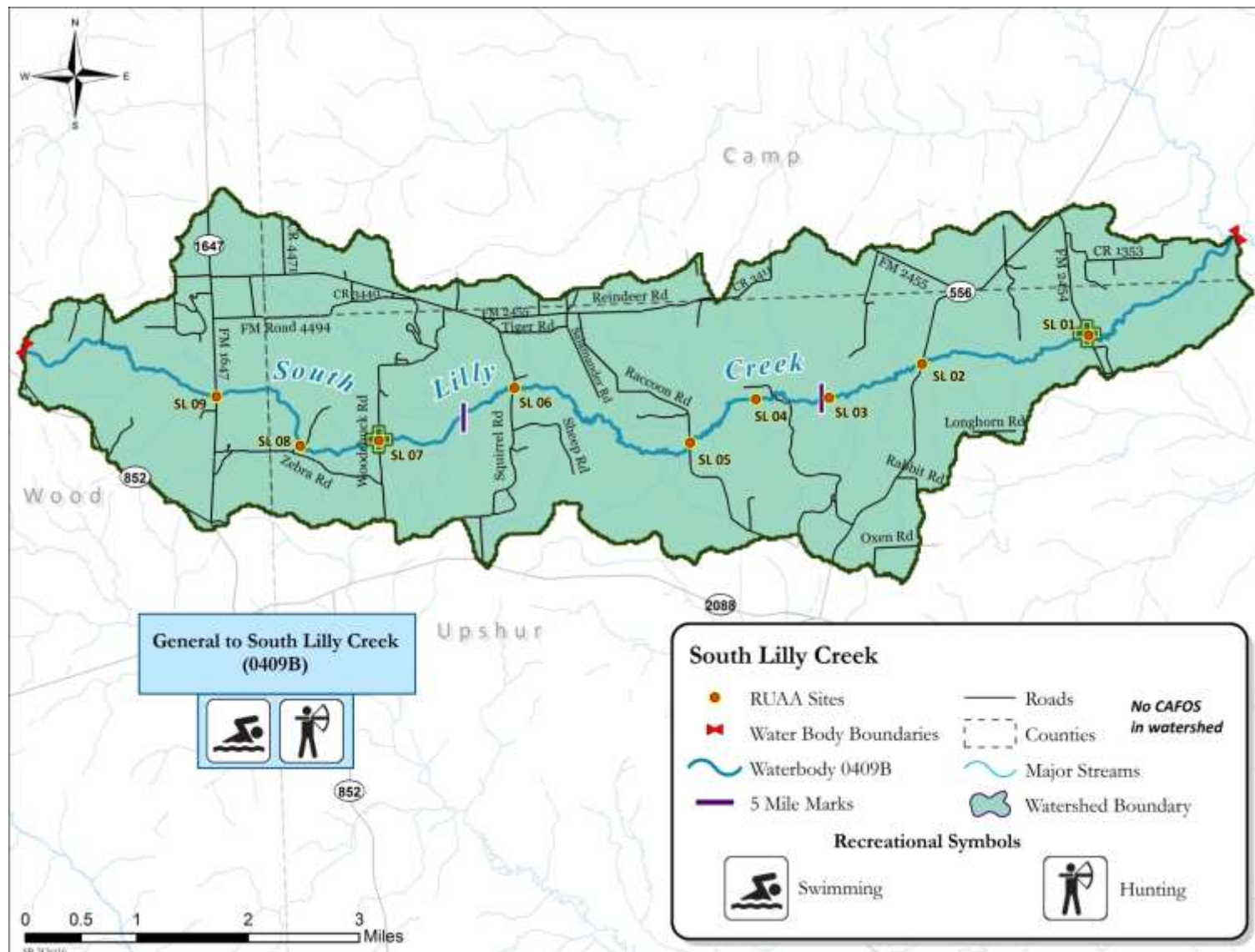


Figure 4.20 Summary of observed and interviewed human activities on South Lilly Creek.

RUAA Summary  
(Not part of the Field Data Sheet)

*This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.*

Name of water body: South Lilly Creek  
Segment No. of Nearest Downstream Segment No.: 0409B  
Classified?: No  
County: Wood, Camp, Upshur

1. Observations on Use

- a. Do primary contact recreation activities occur on the water body?  
☐ frequently    ☒ seldom    ☐ not observed or reported    ☐ unknown
- b. Do secondary contact recreation 1 activities occur on the water body?  
☐ frequently    ☐ seldom    ☒ not observed or reported    ☐ unknown
- c. Do secondary contact recreation 2 activities occur on the water body?  
☐ frequently    ☐ seldom    ☒ not observed or reported    ☐ unknown
- d. Do noncontact recreation activities occur on the water body?  
☐ frequently    ☒ seldom    ☐ not observed or reported    ☐ unknown

2. Physical Characteristics of Water Body

- a. What is the average thalweg depth? 0.49 meters
- b. Are there substantial pools deeper than 1 meter?    ☐ Yes    ☒ No
- c. What is the general level of public access?  
☐ easy    ☐ moderate    ☒ very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

- ☐ Mild-Extreme Drought
- ☐ Incipient dry spell
- ☐ Near Normal
- ☒ Incipient wet spell
- ☐ Mild-Extreme Wet

## References

- AVMA, American Veterinary Medical Association. 2012. U.S. Pet Ownership Statistics. Online at: <https://www.avma.org/KB/Resources/Statistics/Pages/Market-research-statistics-US-pet-ownership.aspx> (verified September 27, 2016).
- Griffith, G., S. Bryce, J. Omernik, and A. Rogers. 2007. Ecoregions of Texas. Project report to the Texas Commission on Environmental Quality, Austin, Texas (AS-199, 12/07).
- NOAA, National Oceanic and Atmospheric Administration. 2015. National Climatic Data Center, Available at <https://www.ncdc.noaa.gov/cdo-web/> (link verified September 27, 2016)
- TCEQ, Texas Commission on Environmental Quality. 2014a. 2014 Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d), approved November 19, 2015. Available at [https://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/14txir/2014\\_303d.pdf](https://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/14txir/2014_303d.pdf) (link verified September 27, 2016).
- TCEQ, Texas Commission on Environmental Quality. 2014b. Recreational Use-Attainability Analyses (RUAA's) - Procedures for a Comprehensive RUAA and a Basic RUAA Survey. (March 2014). Available on-line at: [http://www.tceq.state.tx.us/assets/public/waterquality/standards/ruaa/Recreational%20UAA%20Procedures\\_Final\\_2014.pdf](http://www.tceq.state.tx.us/assets/public/waterquality/standards/ruaa/Recreational%20UAA%20Procedures_Final_2014.pdf) (link verified September 27, 2016).
- TCEQ, Texas Commission on Environmental Quality. 2010. 2010 Texas Surface Water Quality Standards. Available at <http://www.tceq.texas.gov/waterquality/standards/2010standards.html> (link verified September 27, 2016).
- TIAER, Texas Institute for Applied Environmental Research. 2016. Recreational Use Attainability Analysis for White Oak Creek (0303B) and South Lilly Creek (0409B), TSSWCB Project 16-60, Quality Assurance Project Plan, Rev. 1. Prepared by TIAER, Tarleton State University, Stephenville, TX.
- TWDB. Texas Water Development Board. 2015. Palmer Hydrological Drought Index (Monthly). Available at <http://waterdatafortexas.org/drought/phdi/monthly?time=2016-07> (link verified October 5, 2016).
- USCB, United States Census Bureau. 2010. Census 2010 Data, Washington D.C. Census Block Data available at <http://www.census.gov/geo/maps-data/data/tiger-data.html> with demographic data available at <http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t> (links verified September 27, 2016).
- USDA, U.S. Department of Agriculture. 2012. National Agricultural Statistics Service. Available at <http://www.agcensus.usda.gov/Publications/2012/> (link verified September 27, 2016).
- USEPA, U.S. Environmental Protection Agency. 2009. In: Drinking Water Contaminants. Available online at <http://water.epa.gov/drink/contaminants/> (link verified September 27, 2016).



- USGS, United States Geological Survey. 2011 Multi-Resolution Land Characterization (MRLC) Consortium, 2011 National Land Cover Database (NLCD). Available at <http://www.mrlc.gov/index.php> (link verified September 27, 2016).
- Weather Underground. The Weather Company, LLC. 2016. Precipitation and temperature history for weather station KTXPITTS2 Broach Park, Pittsburg, Texas. Available at: <https://www.wunderground.com/personalweatherstation/dashboard?ID=KTXPITTS2#history/tdata/s20160520/e20160824/mcustom> (link verified October 5, 2016)